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ABSTRACT

The educational requirements of a world science information system (UNISIST) are dealt with in the first part of this paper. The educational needs of: 1) the information scientists who design information systems, 2) the information specialists who carry out specific tasks, 3) the scientists who use information, and 4) editors and publishers are outlined. The growing sophistication of the organization, methods and techniques of information transfer are reviewed, and the point is made that new educational programs are needed if UNISIST is to be a useful entity. The second section of the paper discusses the contirubtions which professional societies can make to training and manpower problems and describes the manpower problems of modern science. Following this, specific suggestions are put forth concerning teaching methods, techniques, curricula and educational management. (Author)

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EDUCATIONAL AND TRAINING ISSUES IN UNISIST

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This paper is presented in two parts, the first part dealing with the educational requirements of a world science information system (UNISIST) and the second with the proposed action and recommendations concerning training and education in the field of scientific information.

In Part I the educational requirements of information scientists, information specialists, scientists, (information users) and editors and publishers are outlined. With the growing sophistication of the organization, methods and techniques of information transfer, these groups must extend their educational programmes or introduce new ones if they are to participate effectively in and profit from a world science information system.

Of the 22 Recommendations of the UNISIST Study Report, Recomm. 12 concerning the contribution of professional societies to training and manpower issues and Recomm. 13 concerning manpower development, are taken as the basis for the proposed action and recommendations concerning training and education dealt with in Part II of this paper. The specific aspects/topics discussed are teaching methods, techniques, curricula and educational management.

A very important part of the UNISIST Study Report [1] is devoted to educational issues, both in the requirements for the establishment of UNISIST and in the solutions and recommendations for its implementation.

Training and education in scientific information as presented in the UNISIST Report are pertinent to two factors: one, the existing general trends in teaching and training of scientists and engineers, and two, the professional requirements of scientific information concerning information control, processing and use; and also the design and operation of information systems and their components.

The presentation of educational issues in the UNISIST Study is general, due to the multi-functional character of the project which must reflect all possible aspects of scientific information related to the feasibility of the world science information system Therefore, the considerations and proposed solutions are rather indicativ and do not deal with concrete structures of scientific information education which will be chiefly determined by the general situation in each individual

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country, and particularly by the prevalent state of industrial development, economic resources and the needs of the specialists.

In this paper, I should like to describe and comment upon the educational and training issues which form one of the programme objectives of UNISIST (III). The Report states that « UNISIST should work to develop the human resources essential to the planning and operation of a future information network ».

My observations on this important subject will be presented in two parts:

1. The educational requirements of the world information system;
2. Proposed action and recommendations concerning training and education.

A preliminary foreword is needed. The UNISIST Study will be submitted to the participants of the Intergovernmental Conference which will take place in Paris in October 1971 to discuss the proposed recommendations, but as this paper was written in August, it is evident that it cannot take into consideration the results of the Conference.

I. *Educational Requirements.*

The educational requirements in scientific information relate to several professional groups, namely:

a. documentalists;

b. scientists (information users);

c. editors and publishers.

a. *Documentalists*

Information work, as described in an ASLIB booklet[2] offers a stimulating and demanding career to graduates with lively minds. It brings them into contact with all kinds of people, including those at the heart of the struggle to increase man's knowledge and powers. It demands and develops a knowledge of a wide range of subjects and at the same time gives the documentalist the satisfaction of establishing himself as an authority on the literature of the subject, or subjects, in which he specializes. It is also a field in which exciting new developments may be expected. Advances in electronics have opened up the possibility of applying automation to certain aspects of information work, notably to the preparation of indexes in much finer detail; this is involving a rethinking of many traditional disciplines such as classification.

These conditions of work determine in a certain sense the professional background of the documentalists and determine also the educational and training requirements.

Generally speaking, « documentalists » can be divided in two broad categories: *information specialists* (information officers, or science information specialists) and *information scientists.*

The *information specialist* is a service-oriented person, as against a research and development person. Existing practice shows that the information specialist can have a position at any of the different stages of information processing, such as: collecting, indexing, retrieval, etc. In this profession, each position requires the incumbent to have, in addition to the subject knowledge, at least one of the following qualifications:

a. professional library education and experience;
b. administrative ability and experience;
c. knowledge of non-traditional information systems and instrumentation;
d. foreign language proficiency.

What needs to be stressed is the scope of this profession, the intellectual stimulus, and the variety of opportunities it affords men and women for using their training, knowledge and imagination. At every step of the information process there is a need for evaluation of the information and at the last step an opportunity to interpret materials to facilitate their use [3].

The *information scientist* should at least have a B. Sc. or better, a Ph. D. in engineering or in science. Besides a knowledge of library sciences, which covers classification, indexing, subject analysis and equipment, he should have qualifications in linguistics, human engineering, mathematics, logic, systems design and communication sciences [4]. His work relates rather to the design of information systems and its development, than to the more specific tasks of scientific information processing.

In the UNISIST Report the educational requirements are concentrated mainly on the group of information specialists.

The future of science information is, to a large extent, conditioned by the responsibility of the profession in a changing environment. The word « profession » may seem unclear: the reason is that many different categories are involved in the process, all of which have to adjust to new requirements and to new ways of meeting them, intellectual, technical and organizational. One such category is the user community itself. The frontier between *scientists and documentalists* has been somewhat shifted by the necessary involvement of each in functions that were previously left more or less to the other: abstracting, indexing, building-up classifications and thesauri, providing evaluated reviews and state-of-the-art reports, deciding on the information value or obsolescence of documents. The implication is that *scientists*, or at least some of them, should now receive a certain amount of training

in the techniques of information transfer, so that they may co-operate with documentalists in expediting any of the above tasks. Conversely, the functions of *documentalists* are to be revised in two respects: firstly, a deeper knowledge and understanding of the language and findings of science is required in order to be able to accomplish intelligently even the more primitive kinds of subject cataloguing and document indexing in any special field; secondly, a new proficiency is needed in disciplines such as linguistics, mathematics and the computing sciences, in so far as they are contributing to the evolution of more sophisticated methods of information analysis and retrieval. The technicalities of the profession have become such that it may soon be necessary to split into a number of separate branches, e.g. natural processing, file organization and maintenance, etc...

So far, few countries, even among the « major » ones, have developed adequate education programmes to meet this challenge. Those which have, naturally enough, are also those in which the present state of information science is most advanced; the process thus tends to be cumulative, and differences in the know-how increase as experimentation with new information techniques in turn provides opportunities for training users and processors in the most practical fashion. This phenomenon is all too well-known: it is nothing but the « natural » cause of differences in economic and industrial development in a world of unevenly distributed resources. The information transfer field is no exception, but the educational disparities observed in this section have an added effect on the access to knowledge in others. The long term consequences of retardation in information science are therefore enormous. Yet there is no evidence that this trivial fact has been recognized by the education and science planners in all nations.

It is essential that all parties to the operation of cross-national information systems be intellectually self-supporting, that is, they must be capable of managing and improving a fully-fledged sub-system at the overall standard, without having to depend upon external assistance or to reduce the scope of their contribution for lack of skilled personnel. If this is an accepted goal, then there is no alternative but to develop, through the co-operation of all nations concerned, a minimum education programme, to be administrereed on a regional basis, for the training of research and practising specialists in all branches of information science.

b. *Scientists* (*Information users*)

The second professional group to which the educational requirements in the UNISIST Report are addressed is scientists as information producers and users. The fact that scientists produce and use information determines two kinds of educational requirements: at the level of the preparation of scientific information, and at the level of

its use. All scientists are obliged to find, evaluate and synthesize information, but the relative importance of information techniques to the scientist depends on: *a.* the concentration of the scientist's time in laboratories, literature or field work; *b.* the theoretical or applied nature of the scientist's work: *c.* the scope of his scientific interest; *d.* the competition for information; *e.* the adaptability of the information facility and its staff to the needs of scientists; *f.* the recorded form, language and security restrictions used by other scientists working in his discipline.

To expect scientists to do much of their own literature searching is normal, but this expectation should not be accompanied by complacency. The scientist has his own concept of what he wants and he often lacks confidence in the information specialist's intuitive grasp of the subject. The information specialist must earn his spurs, but his way will be made easier if the scientist and the engineer accept him as a member of the team on a basis of equality. The scientist, in turn, will learn more about information handling and will gain a valuable follow-up on leads that he himself has no time to pursue [5].

As the costs of information transfer are rising faster than ever before, due to the increasing dependence upon expensive technology, it becomes all the more urgent to find or develop ways of saving money in the overall design of the process. This, first of all, requires the involvement of scientists in information work.

At the very earliest stage in the relay of information authors could play a part in alleviating the burden of information handling, through better writing, preparation of abstracts, assignment of subject headings, etc. Several years ago, in 1963, one of the major findings of the Weinberg Report in the USA was that « authors must accept more responsibility for information retrieval »; many scientific unions and documentation organizations have since made similar recommendations in presenting style manuals, handbooks for authors, guides for the preparation of abstracts, instructions to editors, etc. Despite so much concerted exhortation progress in this direction has been slow: less than half of the existing primary journals demand the inclusion of an abstract as a condition of publication and the proportion of author abstracts in some of the major secondary journals is still distressingly low. In the same way, only a small percentage of primary journals make a point of forwarding abstracts to the proper abstracting services. As for deep indexing by authors or editors, it is still at the experimental phase rather than a current practice.

The involvement of scientists in information matters is an indispensable complement to the specialization of documentalists in science information.

In this part, I have first retraced how scientists should be more involved in information handling, then how authors can help to meet

the information requirements of potential users; then the emphasis was on turning users into information officers of the highest grade, for the preparation of critical reviews. This cycle of analysis and synthesis involves scientists, not documentalists; and the question arises of redefining the relations between the two professions. A redistribution of tasks will have to be provided for, with scientists taking on the more content-oriented tasks of document and data analysis, as above, and documentalists, archivists, librarians, etc... adjusting to the new technicalities of information transfer, in so far as they do not call for a deep understanding of document content and significance. Education programmes are needed for both groups.

c. *Editors and publishers*

Other professional groups are concerned by the changes being implemented in the patterns of information handling. Editors and publishers of scientific journals are necessary partners for bringing about improvements in journal presentation and circulation. The interaction between information specialists and scientists in general would be made easier by the setting up or strengthening of regional and/or sectional associations of editors, through which improvements could more easily be discussed, enforced and adjusted than by a multiplicity of local unrelated arrangements. Concerted reflection and action could thus develop matters of common concern to publishers, journal editors, and information specialists: not only format or type standards, but also the involvement of authors in abstracting and indexing, the part to be played by editorial supervision, co-operative schemes for sharing the costs of data input, or expediting advanced material through improved communication media, etc... Standing issues such as the possible revision of the goals and principles of primary documentation would also best be discussed with publishers; other open problems, at this high level, are the case for new forms of repositories in which unpublished data compilations could be stored, the revision of current practice in depository systems (*dépôt légal*) and the harmonization of pricing policies.

The development of editors' associations would and has already provided a useful channel through which matters of common concern are discussed. Not only the members of already existing associations but also participants of the preparatory meetings for future associations recognize the following points as their main common problems, which could be also treated as requirements for future educational and training programmes:

1. *Presentation of articles and journals*

The technique of writing a journal article is bound up with the principles of experimental design and scientific method and deserves

an important place in a scientist's education. Future revision of existing style manuals might include writing as well as training in journal management.

2. *New methods*

Continuing effort is to be made towards evaluating and implementing new methods that may increase the overall effectiveness of primary and secondary publications, e. g. advance procurement of references; dissemination of current titles, joint support of special depositories, co-operative agreements for exchanging abstracts in one or several languages, etc.

3. *New forms of publications*

Complementary or alternative forms of document presentation and distribution can be subjects of training, e. g. « letter journals »; « limited scope journals »; for specific and unspecified subscribers; other documents in a different form (microfiches); etc.. The rapid development of computer technology permits the adoption of new techniques intended ultimately to reduce the costs of publications to individual users, e. g. new printing devices, computer-assisted composition, schemes for sharing the burden of data input, etc. Individual publishers are not always in a position to acquire relevant information on current progress, even less to take single-handed actions along any of the lines suggested above.

So there are good reasons for having an international programme for the training of editors, especially for an exchange of experience in the above-mentioned matters.

II. *Proposed actions and recommendations.*

The results of the UNISIST study have been formulated in twenty-two recommendations dealing with several items which are necessary for the establishment and development for a world wide international programme of co-operation in scientific information.

One group of these recommendations is directed towards human resources in scientific information activities. This concerns also the educational and training issues of information specialists and users. Recommendation Number 13 is specially allied to these matters; it reads as follows:

> *Recommendation 13* — For all nations to take active share in the operation of international information systems, a concerted effort is needed to provide information specialists, librarians and documentalists with improved educational facilities; UNISIST should

encourage competent professional organizations such as IFLA, FID, IFIP, and others, to organize this effort with the co-operation of the scientific unions as representatives of producers and users of information — as well as governmental bodies. Attention should be given to the desirability and feasibility of internationally-oriented training and educational assistance programmes, which might include proposals for pooling resources, where needed, in a number of regional education centres.

The educational requirements of a world science information system, summarized in the first part of this paper, concern scientists on the one hand, in their capacity as agents in the switching process, and information specialists on the other, including librarian analysts, reprographists, etc. Appropriate measures have already been taken in some countries to provide or up-date education programmes in information science at university level. This, however, is by no means a general course in all parts of the world: many countries, even among the more developed, suffer from a serious lack of trained personnel to set up or handle modern information systems; and yet, they seem to shun the underlying educational issue. Such disparities cannot but endanger the success of a world-wide information sharing system, as envisaged in UNISIST; it need not be demonstrated that the very principle of sharing between several parties, the operation of an international information system (rather than only the use of products and services provided by a few of them) implies that each participant has reached a minimum level of understanding and performance for all stages of the process (document analysis, information and data input, processing and communication techniques, etc.).

The « participants », ultimately, are the producers and users of information, namely the scientists themselves, as well as the librarians, documentalists, engineers, etc. who take part in the transfer chain, from producers to users. The training requirements of the former group have been mentioned in the preceding section; they ought to be further specified, together with the programmes which would seem best suited to meet them, taking into account the diversity of national practices and resources in education; international organizations such as FID which have recently gained some experience in this area, could be entrusted with further studies to that effect, in collaboration with ICSU, WFEO, etc.

As for the second group — information specialists in the broad sense — educational programmes now exist by the dozen, as shown by recent inventories conducted on a national or international basis. Their diversity reflects in part the legitimate bias of particular institutions toward different facets of information handling, according to local skills or requirements. For this reason, world-wide standardization is not a desirable goal. Nevertheless as mentioned earlier, the

level of proficiency observed in some parts of the world — both developing and developed — can be shown impartially to remain below the requirements of information processing in a modern sense, either from a qualitative viewpoint (inadequate programmes), or quantitative (insufficient number of skilled personnel), or both. A few practical steps could be taken with the support of UNISIST to bring about a more even distribution of trained information experts, at different levels of proficiency - e. g. *a.* devising alternative educational programmes on the basis of existing curricula in the more advanced countries, to provide librarians and documentalists with graded bodies of knowledge consonant with the operational requirements of multi-national and multi-lingual networks, while mindful of regional limitations in resources; the cooperation of international organizations such as FID would again be helpful in this context, especially in view of its experience with training programmes in developing as well as developed countries; *b.* promoting the preparation of handbooks and other curriculum material for the different grades (including on-the-job training, continuing education courses, etc.), in as many language as may seem fit to ensure worldwide effectiveness; the use of computer-assisted instruction in the art of information retrieval could be included among the topics which deserve attention in this connexion, as a potential answer to the shortage of skilled teachers, and also as a means to familiarize librarians and documentalists with the more sophisticated information techniques (on-line processing, conversational computers, etc.), *c.* a reinforcement of international professional associations that ought ultimately to take the responsibility for much of the effort advocated in this section (FID, IFLA, IFIP).

The training and manpower issues have also been considered in recommendation Number 12 concerning the contribution of professional societies, in which the international federations of scientific societies are asking for the training of scientists in information processing in the requirements, techniques and use of information transfer systems through formal courses, as well as on-the-job participation in operational or pilot projects of international dimensions.

Qualified manpower also plays a very important rôle in ensuring the access to scientific and technical information which forms part of national information policies. The UNISIST recommendations which are addressed to the governments ask for the creation of suitable institutional environments for the development and improvement of scientific information. These recommendations suggest that more attention should be paid to educational issues as a condition *sine qua non* of improving the access to scientific information.

The growing sophistication of the organization, methods and techniques of information transfer makes it mandatory for UNISIST adherents to develop equal skills in this industry. However, wide dispari-

ties occur in this respect from one part of the world to another; the attention of education and science planners should be drawn to the dangers of a failure on their part to observe minimum standards in the training of all categories of personnel — including scientists — responsible for information handling. Special care should be given in this connexion to: *a.* developing adequate national or regional programmes of education in information science; *b.* providing means and opportunities for research activities in this field; *c.* improving the effectiveness of education in foreign languages, while developing, on the other hand, translation skills and facilities, as partial answers to the language barrier issue; *d.* raising the standards of proficiency in the more advanced applications of computer and communication tecnology relevant to the progress of UNISIST.

UNESCO's experience in the development of educational programmes, especially in the fields of engineers and scientists, could and should be used also in the education and training of information specialists. This concerns both teaching methods and educational management. During the recent discussions on UNISIST with the representatives of UN Agencies, this question was raised and several representatives suggested that UNESCO should be a world focal point for the training and education of information specialists and that this programme should have the first priority in the framework of the UNISIST project [6].

In the hope that for this « International Conference on Training for Information Work » the general trends in education of scientists and engineers could be of great value, I will cite several recommendations (in a modified form) proposed by the participants of the International Conference on the Trends in the Teaching and Training of Engineers, which took place in Paris, in December 1968. I am convinced that these general recommendations could also find their application in the training of information specialists:

Teaching methods, techniques and curricula

Attention should be given to the increasingly available teaching aids such as audio-visual techniques, digital computers, programmed learning, and the like. It would be desirable to provide information generally on the status of development of these aids and of their usefulness in various situations.

In general, the advances in education techniques, in methods of teaching and learning and development of curricula and course content, and in faculty development appear in many forms and are occurring in many institutions, in many countries, in different ways. These advances and developments are of greatest value to all institutions of all countries, and there should be a much more extensive organization

and procedure for the dissemination of information about these advances and developments.

The design of information specialists' curricula, particularly for developing countries, while aiming at a high level of theoretical instruction, should include provision for an adequate practical orientation. In all cases, the curriculum should include those studies, reports, projects, both experimental and analytical which would provide an emphasis on creative design and an opportunity to demonstrate capability through project activity.

Educational management

In order to serve the needs of developing and small countries in the improvement of faculty staff, it would be desirable to establish an independent international re-training and exchange centre for professors and lecturers.

The initial education of an information specialist should be based on the assumption that it will be followed by continuing life-long education and all those concerned with the scientific information profession should plan on this basis.

To provide the necessary facilities for education and training, and also in the interest of international understanding, it is desirable that there should be exchanges of students and junior specialists and information on programmes and courses on an increasing scale, and that university or technical centres of industrial countries give their help and experience to the education and training programmes of developing countries.

It is advisable that informaton be available on the state of scientific information education and the profession in all countries. This should include universities and technical institutes, their organization, operation, management and financing, and the kinds of full-time and part-time educational programmes offered at all levels. Information should be provided on the structure and scope of the activities of regional and national professional societies of all types, and their relationships with the universities, industries, governments, and with each other. Such information should be prepared, in concise form, should include all countries and should be made available to all interested individuals and organizations.

The professional societies and industries should collaborate with the secondary school system in providing information and guidance on careers in information work and should also provide further guidance to students enrolled in higher education.

I would like to conclude this paper with a few words on the action which is envisaged for the implementation of the UNISIST project. As I mentioned earlier, the results of the UNISIST study will be submitted to the Intergovernmental Conference; the outcome of the confer-

ence will be the adoption of the report embodying such conclusions and recommendations as may emerge from the deliberation. It is suggested that the conclusions may express views and findings addressed to the enlightened public to summarize the consensus of the conference on certain problems. The recommendations, on the other hand, call for action; they may be addressed to the Member States, to the Director-General and to the General Conference of UNESCO, to the United Nations and its specialized agencies and to other international organizations. Based on these recommendations, an implementation programme for UNISIST will be established after the Conference and will be submitted to the next UNESCO General Conference in October 1972. This Conference would approve the programme of action as well as the necessary budget and it is expected that UNISIST, as an international programme, will begin to function in 1973.

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